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STRANDED MARINE MAMMALS RECOVERED BY THE SOUTHWEST FISHERIES CENTER, 1966-1980

by

John R. Henderson and Larry J. Hansen

ADMINISTRATIVE REPORT LJ-83-07

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I. INTRODUCTION

Marine mammals often strand on beaches, after dying at sea and washing ashore, by actively seeking land, or by becoming confused or disoriented. These animals are simultaneously a curiosity to the general public, a nuisance to local residents and authorities responsible for beach maintenance, and, in particular, a valuable source of data for the scientist. Since, and in part because of, the 1972 enactment of the Marine Mammal Protection Act (MMPA), public awareness of stranded marine mammals has increased, with a commensurate increase in the need for timely response to each stranding event. The protection afforded marine mammals by the MMPA has also increased the importance of strandings to the research scientist, who is no longer able to readily collect specimens as needs dictate.

Strandings are often the only sources of information for research on marine mammals. Stranding data contribute to the knowledge of systematics, abundance, distribution, life history, and ecology of many species. Specifically, long term records of the frequency and location of strandings may reveal changes in the relative abundance of populations, or spatial population shifts (Sergeant, 1979). Skeletal material provides morphometric and meristic data which can help define intra-specific populations, particularly of cetacean species. Different populations may also be evidenced by the presence or absence of certain parasites which can serve as "biological tags" indicative of disparate distributions and/or feeding regimes. Determination of the age and reproductive status of stranded animals contributes to knowledge of vital rates, information which must be considered in stock assessment and in management decisions. Competition between marine mammals and man for fishery resources may be evidenced by stomach contents of stranded marine mammals; marine mammal-fishery interactions, either incidental encounters with fishing gear or deliberate harassment by fishermen, may be apparent from detailed post-mortem examinations (Stroud and Roffe, 1979).

From 1966 to 1979, when no formal stranding recovery project existed at the Southwest Fisheries Center (SWFC), no regular effort was made to inform

all beach patrol agencies (lifeguards, park rangers, etc.) of the SWFC's interest in stranded cetaceans. Whenever SWFC staff investigated a cetacean stranding (often having been informed second or third hand), those persons retrieving the animal informed people from patrol agencies at the scene that SWFC would investigate stranded cetaceans and requested notification of future strandings. Thus, 1969-1979 represents a time of gradually increasing awareness on the part of beach-patrol agencies in San Diego County that SWFC would investigate stranded cetaceans.

In 1979, with the inception of the Cooperative Marine Mammal Salvage Program, all agencies responsible for patrol, maintenance, and safety on San Diego County beaches (listed in Appendix I) were formally notified that the SWFC and other cooperating agencies would respond to any stranding in San Diego County.

II. PROCEDURES

A. Source of Data

This report summarizes all San Diego County strandings which SWFC personnel have investigated through 1980. The extent of investigations by the SWFC has varied. From 1966 to 1979, personnel of the SWFC investigated all reports of dead cetaceans on San Diego beaches. Reports of live stranded animals (both cetaceans and pinnipeds) were generally referred to Sea World, Inc., although SWFC personnel on occasion assisted in the recovery of live cetaceans. These cetaceans are included in the data.

With very few exceptions, all reports of dead pinnipeds were, until 1979, referred to the California Department of Fish and Game (CDF&G), with no investigation by the SWFC. In mid-1979, the SWFC began retrieving dead pinnipeds on a more regular basis, and in 1980, SWFC staff endeavored to investigate all reports of dead pinnipeds. All reports of live stranded pinnipeds continue to be referred to Sea World, and no live stranded pinnipeds are included in this report.

B. The Cooperative Marine Mammal Salvage Program

In 1979 the Cooperative Marine Mammal Salvage Program was established in San Diego County. The purpose of the program is to ensure prompt response by marine mammalogists to any stranding event within a prescribed section of coastline, to provide a framework whereby basic minimal data are cataloged for all strandings, and to facilitate the acquisition and exchange of additional data which are relevant to the research interests of each cooperating institution. The program includes primary cooperators who are willing to dispatch personnel to stranding events and for whom specimens will be routinely collected. The primary cooperators are Hubbs-Sea World Research Institute (HSWRI), Naval Ocean Systems Center (NOSC), Sea World Inc. (SW) and SWFC. Secondary cooperators are also available for strandings which require personnel to assist a primary response team.

A single, central telephone line, (619) 234-1991, receives all incoming reports. The phone is staffed during normal working hours by CDF&G, and during evenings and weekends by a commercial answering service. Those reporting strandings are queried as to whether the animal is alive or dead, as well as to the location and accessibility of the stranding. Cooperators are then notified according to the condition of the animal (live animals covered by SW and NOSC, dead by SWFC and HSWRI), and an investigation team is dispatched.

The Cooperative Marine Mammal Salvage Program in San Diego County is a participant in the Southwest Regional Stranding Network which was organized following the 1977 Marine Mammal Stranding Workshop in Athens, Georgia (Geraci and St. Aubin, 1979). Stranding reports are regularly submitted to the NMFS Southwest Regional Office, as well as to the Smithsonian Institution.

C. Data Collected and Derived from Strandings

Data from stranded animals were collected in accordance with guidelines developed at the Marine Mammal Stranding Workshop (Geraci and St. Aubin, 1979). The following information ("Level A: Basic Minimum Data") was recorded from every stranding.

1. Species
2. Sex
3. Length
4. Number of animals involved
5. Location (including geographic coordinates)
6. Reporting source
7. Individuals investigating
8. Initial disposition of specimen

A field number was assigned to every stranded animal, and photographs were taken to corroborate the data. Morphometric and meristic data were collected from all cetaceans when feasible.

Specimens from stranded animals were collected according to the species and condition of the carcass and in conjunction with the needs of cooperating institutions. Fresh dead carcasses (except for those of whales) were frozen and retained for subsequent necropsy to determine the probable cause(s) of death. Decomposed carcasses were worked up upon retrieval, either at the stranding site or after removal to a disposal site. The following materials were collected whenever possible.

1. From cetaceans:

    a. External measurements, if condition warranted.
    b. Skeleton if physically mature, otherwise skull, flippers and vertebral counts only.
    c. Gonads and fetus (in utero) if present.
    d. Stomach contents.
    e. Tissue samples for pesticide/heavy metal analysis (if carcass

was fresh).
f. Parasites.

2. From pinnipeds

a. Skull (if physically mature, otherwise mandible only).
b. Stomach contents.
c. Tissue samples for pesticide/heavy metal analysis (if carcass was fresh).
d. Parasites.

III. RESULTS

A. Cetaceans

1. Number of strandings.

Cetacean strandings which SWFC investigated totaled 122 animals representing 13 species (Table 1). No multiple or mass strandings occurred during this period, hence Table 1 represents 122 separate events. However, two specimens of Mesoplodon hectori (Hector's beaked whale) which stranded in 1975 may have been circumstantially related, as a long-dead 444-cm female stranded approximately 10 km from where a 210-cm calf had been found one week earlier. (Appendix II details each stranding.)

The most frequently stranded cetacean over the entire interval was the common dolphin, Delphinus delphis (46%), though in more recent years (1976-1980), the bottlenose dolphin, Tursiops truncatus, has been more frequent (15% versus 11% for Delphinus). The third through fifth-ranking species, as defined by total animals stranded, were the Pacific white-side dolphin, Lagenorhynchus obliquidens (9%), the gray whale, Eschrichtius robustus (8%), and the Dall's porpoise, Phocoenoides dalli (4%). All of the gray whales have stranded since 1974.

The annual total of all cetaceans stranded has fluctuated considerably, with no consistent increase or decrease evident. To some extent, fluctuations before the inception of the Cooperative Marine Mammal Salvage Program may reflect varying coverage effort.

2. Location of strandings.

Of the 122 cetaceans included in this report, 116 that stranded at known localities in San Diego County are summarized in Figure 1. Of the seven others, five were from imprecisely known localities and two were found or recovered floating at sea. Distribution of strandings along the San Diego County coastline was relatively uniform except for the high incidence (38% or 43 of 116) that occurred between Penasquitos Lagoon and La Jolla Point.

Virtually all cetaceans (98% or 114 of 116) stranded on gently sloping areas, though not necessarily on sandy beaches, as the sand had been eroded away in some areas to leave gently sloping rocky beaches. The two exceptions (one gray whale and one Risso's dolphin, Grampus griseus) both stranded at the base of a precipitous, 30 m high cliff along Pt. Loma, San Diego (32°41'N; 119°15'W). There is no beach in this area; the ocean borders on a rock "rip-rap" wall installed to retard cliff erosion. The gray whale had been floating dead approximately 100 m offshore for at least one week prior to being blown ashore by prevailing winds. The Risso's dolphin, however, stranded alive along the cliff base, struggling against the rock wall for approximately one hour before being held away from the rocks by onlookers. (Rescue was effected by lifeguards using a crane and hoist designed for cliff rescues.)

3. Seasonality of strandings.

Of the 122 cetaceans stranding, 18 were noted as being extensively decomposed. Therefore, the date of their recovery may not approximate the date of stranding. The remaining 105 are shown by month of stranding in Figure 2. Reported strandings were more numerous in spring and summer months (March-July) than in the fall and winter. The common dolphin stranded most often in the months March-July, while strandings of the bottlenose dolphin peaked in August. All strandings (10) of the gray whale occurred in the interval from October to May.

B. Pinnipeds

In the 18 months during which stranding reports of pinnipeds were routinely investigated (mid-1979 through 1980), 19 animals were recovered: 17 California sea lions, Zalophus californianus, and two northern elephant seals, Mirounga angustirostris. All pinnipeds investigated are listed in Appendix III.

C. Necropsy results

Because the procedure of routinely conducting a necropsy on stranded marine mammals was initiated in mid-1980, only 20 animals (three from strandings outside of San Diego County) were necropsied during the period covered by this report (Table 2). Of the 20 animals, 10 died from bacterial infections, 4 from parasite-induced pathology (including brain necrosis in three common dolphins), 2 were stillborn, 2 were too decomposed for evaluation, and the diagnoses for 2 remain open.

D. Food Habits

The stomachs of stranded cetaceans are usually empty or contain very small amounts of food remains and are of little use for food habit studies. However, between 20-30% of stranded pinnipeds have full stomachs; these are inevitably animals which have died from traumatic injuries (Hansen[1]). These pinnipeds are especially useful for food-habit studies. The stomach contents

of 37% of the stranded pinnipeds were collected and are currently being analyzed (along with those collected after 1980).

IV. DISCUSSION

Among the 13 cetacean species represented by the strandings, all but one have been previously reported from Pacific coast strandings. The exception is Hector's beaked whale (four strandings), known previously from only the southern hemisphere (Mead, 1981).

The recent displacement of common dolphins by bottlenose dolphins as the most commonly stranded cetacean is noteworthy, as changes in the relative numbers of stranded individuals of various species may mirror changes in the relative abundance of those species (Sergeant, 1979). However, there are other factors which could be responsible for the changes in stranding frequency. For instance, offshore cetaceans are more likely to strand alive than inshore cetaceans (Mead, 1979). All of the bottlenose dolphins have been of an inshore population (Walker, 1981), while common dolphins are primarily offshore animals (Evans, 1975). Since this report includes very few of the live stranded cetaceans, the numbers of strandings reported do not necessarily reflect the actual stranding rates, especially of offshore species. Before conclusions can be made about stranding rates, records of live stranded animals will have to be reviewed.

Numerous factors need to be considered when evaluating the significance of stranding frequencies. Mead (1979) has suggested that offshore animals are less likely to strand than inshore animals after death because: (1) cetaceans sink when dead, and hydrostatic pressure in deep waters (which offshore species frequent) keeps decomposition gases in solution, making the carcass non-buoyant, (2) inshore animals die in shallow waters, and the carcass becomes buoyant, and (3) carcasses of offshore animals have some distance to travel to reach shore, thus there is more time for scavengers and decomposition to break up the carcass. Sheldrick (1976) suggested changes in food availability as a significant factor; i.e., more food, more animals, more strandings. The lack of food has been implicated only in some exceptional cases (Sheldrick, 1976). The interaction of population size, mortality rate, and movement patterns could also have a definite effect on stranding rates (Mead, 1979). For example, a small offshore population with a seasonally high mortality rate that coincides with inshore movements could have a higher stranding rate than a larger inshore population with a lower mortality rate. Stranding records need to be compared with population estimates, mortality rate estimates, and seasonal movement patterns in order to be properly interpreted. Factors which may affect food availability, such as changes in water temperature, currents, chemical composition, pollution, and commercial

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[1]Hansen, L. J. 1981. Unpublished data. National Marine Fisheries Service, 8604 La Jolla Shores Drive, La Jolla, California 92038.

fisheries, should be investigated.

Site predilection for strandings has been suggested by several researchers, but supporting data are generally confounded by unequal observation or recovery effort by areas. The high incidence of stranded cetaceans between Penasquitos Lagoon and La Jolla Point may result from unequal effort, as the SWFC and Scripps Institution of Oceanography are both located along this beach. However, the head of a large marine canyon also abuts this region (Figure 3); this is the only such canyon along the San Diego County coast. This feature may be more coincident with the high incidence of strandings, as submarine canyons have been implicated in other "preferred" stranding sites (Geraci and St. Aubin, 1979).

The incidence of strandings in non-summer months may be underrepresented due to lower beach use by humans during this time. According to Walker (1974), higher human density during the summer on popular beaches in Los Angeles County, California, was probably responsible for the increased frequency of strandings (due to better reporting) and the frequency of stranding locations (i.e., strandings on popular beaches less likely to go unnoticed). With the development of the Cooperative Marine Mammal Salvage Program, reporting effort should become more uniform, and biases due to seasonal beach use should be eliminated.

The August peak of bottlenose dolphin strandings is distinct from the aggregate seasonal peak from March through May (Figure 2) and may represent a late summer influx of animals, a period of higher mortality, or possibly a breeding season, since all except one of the specimens of T. truncatus recovered during July through September have been calves or neonates (50%) or adult females (40%). T. truncatus calves and neonates have been recovered only during July through September with one exception; a calf was recovered in May but was too decomposed to determine the date of stranding. Adult female bottlenose dolphins have been recovered only from May through October while males have stranded during all seasons. Breeding and calving of bottlenose dolphins are believed to occur all year with peaks in the spring and fall (Leatherwood and Reeves, 1982). These strandings of females, neonates, and calves may indicate a lower rate of calving success during late summer than at other times of the year.

Stranded specimens of D. delphis have been recovered during all months except February and do exhibit a seasonal pattern (Figure 2). These animals are of two different forms which were interpreted as separate species by Banks and Brownell (1969) but are now recognized as the long-beaked and short-beaked forms of common dolphins. The long-beaked form frequents coastal waters within the 100-fathom depth contours of southern California and Baja California, Mexico, and is less numerous than the short-beaked form which is found in the same waters and in offshore waters further north and south (Evans, 1975). Of the 56 common dolphins recovered, 24 were identified as short-beaked and 7 as long-beaked; identification of the others to form was not possible due to the lack of photographs and pertinent measurements for these specimens. The short-beaked form stranded most frequently during March through July (71% of short-beaked strandings); the long-beaked stock stranded most frequently during August (43% of long-beaked strandings) (Figure 4). For

all specimens of D. delphis where the date of stranding is known, the stranding pattern is similar to that of the short-beaked form.

The most interesting feature of the D. delphis strandings is the sex ratio: 3:1 (36 to 12) in favor of the males--3:1 for the short-beaked form and 5:2 for the long-beaked form. Perrin and Oliver (1982) reported on sex ratios of common dolphins incidentally killed during U. S. tuna purse-seining operations in the Pacific; the ratio (male to female) for different stocks varied from 1.13:1 to 0.45:1. For all stocks combined, the sex ratio was 0.85:1 (Perrin and Oliver, 1982).

The reasons for the disparity in the sex ratio of the D. delphis strandings are unclear, but there are several possible explanations. For instance, since 92% of the stranded males were within the length range of sexual maturity for common dolphins reported by Evans (1975) and since the strandings do show a seasonal pattern (Figure 5), it is possible that these strandings may be associated with a breeding season. These males may have stranded as a result of decreased fitness following a breeding season during which aggression between males increased and feeding by males decreased. Walker (1974) reported that the sinus parasite Nasitrema sp. was the major cause of strandings of common dolphins along the Los Angeles County coast from 1970 to 1973. From a sample of 104 wild-caught common dolphins of the eastern tropical Pacific, Walker and Cowan (1981) reported that all of the animals with severe infections of the sinus parasite Nasitrema sp. were males. It may be that the males are more susceptible to the sinus parasite, and when stressed are more likely to die from the infection.

The stranding frequency of common dolphins obviously does not reflect their abundance; it may more likely reflect a seasonal mortality pattern. Evans (1975) reported that the numbers of common dolphins are at their highest levels in southern California waters during January (2.68 animals/sq. mile), June (1.84 animals/sq. mile), September (1.96 animals/sq. mile), and October (2.14 animals/sq. mile); however, only 4% of the common dolphin strandings occurred during January, 13% during June, 7% during September, and 4% during October (Figure 6). Dohl et al. (1978) reported that common dolphins were most abundant in the southern California Bight during October-December (43.8% of total common dolphins sighted) and least abundant during April-June (11.5% of total common dolphins sighted) (Figure 6). The strandings of common dolphins correlate negatively with the findings of Dohl et al. and Evans; the highest percentage of strandings (40%) was recovered during April-June and the lowest (15%) during October-December (Figure 6). The strandings of the northern right whale dolphin (Lissodephis borealis) in the eastern north Pacific also do not reflect its abundance (Leatherwood and Walker, 1979).

V. RECOMMENDATIONS

A. Reporting

During summer months, all public beaches in San Diego County are patrolled by lifeguards, who likely are aware of and report all strandings. During the winter, when patrol of beaches is more sporadic, the general public

becomes an important source of stranding reports. Since the weather in San Diego County generally permits regular beach use during winter months, a well-informed public can provide stranding reports which may, in the aggregate, be free of biases resulting from seasonal beach use. Public awareness of the San Diego County program could be increased via posters, distributed widely and repeatedly in the beach area, and through media announcements, particularly in the regional newspapers serving local beach cities and communities.

The use of a 24-hour number, staffed by operators, provides for prompt reply by qualified personnel. Even if a team is unable to respond immediately, assurance to the caller that the carcass will be inspected and retrieved, even if several days later, will prevent additional calls to uninterested agencies. Furthermore, patrol agencies, if similarly reassured, will be less likely to call for immediate disposal of the carcass by beach maintenance personnel. A prompt, even if only verbal, response to the caller is important, and automatic answering devices delivering a pre-recorded message are unsuitable.

B. Response

All strandings should be inspected and retrieved by a response team (or individual). Only by direct examination can experienced personnel properly record basic minimum data, particularly from pinnipeds, which are often extensively decomposed. Although in San Diego County a report of a "rotten seal" is likely a California sea lion of marginal usefulness due to autolysis, such strandings must be inspected. The decision as to usefulness of a carcass (i.e., "too decomposed or not") should not be left to a reporting source, who may then cease to report strandings of "rotten seals," resulting in a misleading assessment of the number or regularity of pinniped strandings.

A salvage program should be prepared to respond to strandings on weekends. As mentioned above, a weekend response may be merely a verbal assurance that "somebody will pick it up on Monday." The assessment as to urgency of retrieval should be made by experienced personnel, at least one of whom must therefore be available to receive weekend reports.

C. Logistics/Workload

Good logistical support to a salvage program can reduce the staff hours necessary for a response. The piece of equipment which has most supported the Cooperative Marine Mammal Salvage Program has been a 4-wheel drive pickup truck equipped with an hydraulic lift gate. Using this truck, only one person is required to pick up most carcasses (though two are dispatched if possible for safety reasons), as he/she can drive directly to the stranding site and can roll the carcass onto the lift gate. Without such a vehicle a response team must consist of three or four people as it may be necessary to carry a heavy carcass from the stranding site to the vehicle. Due to the high degree of beach use by the public, field dissections are often impractical, particularly in summer months.

Freezer space for storage of carcasses is essential if complete necropsies are to be performed. A series of animals can be examined simultaneously, economizing on the staff hours involved.

The staff necessary to adequately operate a salvage program is dependent on the number of strandings. Most strandings in San Diego County are of the California sea lion, and the frequency of reports varies, from approximately weekly in the fall and winter to virtually daily strandings of recently weaned yearlings in April-June (Hansen[2]). Responding to strandings, collecting specimens, disposing of carcasses, maintaining a field kit, and organizing data and photos require the equivalent of a full-time person. When strandings are very frequent (i.e., daily), up to one-half of another staff member's time may be committed to stranding activities.

D. Analysis

Before a complete analysis of any species stranding frequency and distribution can be done, records of live strandings need to be examined. This can be accomplished by reviewing the marine mammal reports maintained by the California Department of Fish and Game (CDF&G). The recovery of any stranded marine mammal must be reported to the CDF&G; by reviewing its records from 1981 on, a complete history of the strandings for San Diego County from 1981 can be obtained. Once these records are reviewed, the analysis can be completed.

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[2]Ibid.

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Table 1. Summary of stranded cetaceans recovered by SWFC, 1966-1980.

Species	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	TOTAL
Delphinus delphis	1			2	10		9	5	6	9	4	3	1	2	3	55
Tursiops truncatus					1		1	1	2	1	6	3		2	8	25
Lagenorhynchus obliquidens					2	2	1		1		1			1	3	11
Eschrichtius robustus										1	1		3	3	2	10
Phocoenoides dalli						1	1	1		1				1		5
Globicephala macrorhynchus								3							1	4
Mesoplodon hectori										2			1	1		4
Ziphius cavirostris												1			1	2
Lissodelphis borealis								2								2
Mesoplodon carlhubbsi									1							1
Grampus griseus													1			1
Physeter macrocephalus							1									1
Stenella coeruleoalba														1		1
TOTAL	1	0	0	2	13	3	13	12	10	14	12	7	6	11	18	122

Table 2. Pathology of stranded marine mammals in San Diego County.

I.D.	Species	Estimated Age	Gross Pathology	Histologic Pathology	Contributory Cause of Death	Primary Cause of Death
WFP-579*	Delphinus delphis	adult	brain necrosis; vertebral spondylosis	n.d. (autolysis)	------	verminous encephalopathy
WFP-583	Delphinus delphis	sub-adult	brain necrosis	n.d. (autolysis)	-----	verminous encephalopathy
WFP-595	Delphinus delphis	adult	hemorrhagic pneumonia	n.d. (autolysis)	liver abscess; duodenal ulcer	hemorrhagic pneumonia
WFP-596	Mirounga angustirostris	sub-adult	cervical hemorrhage; hemorrhagic pneumonia; emaciation	n.d. (autolysis)	trauma	hemorrhagic pneumonia
JRH-048	Zalophus californianus	yearling	focal dermatitis	n.d. (autolysis)	-----	open
JRH-049	Delphinus delphis	adult	abscess pneumonia; gastric laceration; emaciation	n.d. (autolysis)	gastric ulcer; abscess pneumonia	sepsis
JRH-054	Lagenorhynchus obliquidens	adult	pulmonary hemorrhage	pulmonary congestion	pulmonary congestion	open
JRH-057	Tursiops truncatus	sub-adult	pulmonary congestion; hepatic congestion; duodenal ulceration; cystic mastitis	n.d. (autolysis)	duodenal ulceration	congestive heart failure

* Animal stranded outside of San Diego County

Table 2. Continued

I.D.	Species	Estimated Age	Gross Pathology	Histologic Pathology	Contributory Cause of Death	Primary Cause of Death
JRH-065	Delphinus delphis	adult	none	n.d. (autolysis)	-----	open
JRH-067	Tursiops truncatus	neonate	sub-cutaneous abscess	n.d. (autolysis)	sub-cutaneous abscess	sepsis
JRH-068*	Eumetopias jubatus	yearling	sub-cutaneous abscess; pulmonary exdema; emaciation	broncho-pneumonia	sub-cutaneous abscess	bronchopneumonia
JRH-070	Tursiops truncatus	neonate	none	n.d. (autolysis)	-----	stillborn
JRH-071	Delphinus delphis	adult	emaciation	n.d.	-----	open
JRH-072	Zalophus californianus	adult	parasitic pneumonia; valvular endocarditis; brain necrosis; emaciation	meningitis	parasitic pneumonia	meningitis
JRH-074	Delphinus delphis	adult	brain necrosis	n.d.	-----	cerebral necrosis
JRH-077	Tursiops truncatus	neonate	pulmonary congestion	n.d. (autolysis)	pneumonia	pneumonia

* Animal stranded outside of San Diego County

Table 2. Continued

I.D.	Species	Estimated Age	Gross Pathology	Histologic Pathology	Contributory Cause of Death	Primary Cause of Death
JRH-083	Zalophus californianus	yearling	gastric ulceration; hemorrhagic nephritis	n.d. (autolysis)	gastric ulceration	nephritis (possible leptospirosis)
JRH-084	Tursiops truncatus	yearling	pulmonary abscess	-----	pulmonary abscess	sepsis
JRH-087	Ziphius cavirostris	adult	parasitic hydro-nephrosis	-----	parasitic hydro-nephrosis	nephritis
JRH-097*	Mirounga angustirostris	neonate	interventricular septal defect; pulmonary edema	-----	interventricular septal defect	stillborn

* Animal stranded outside of San Diego County

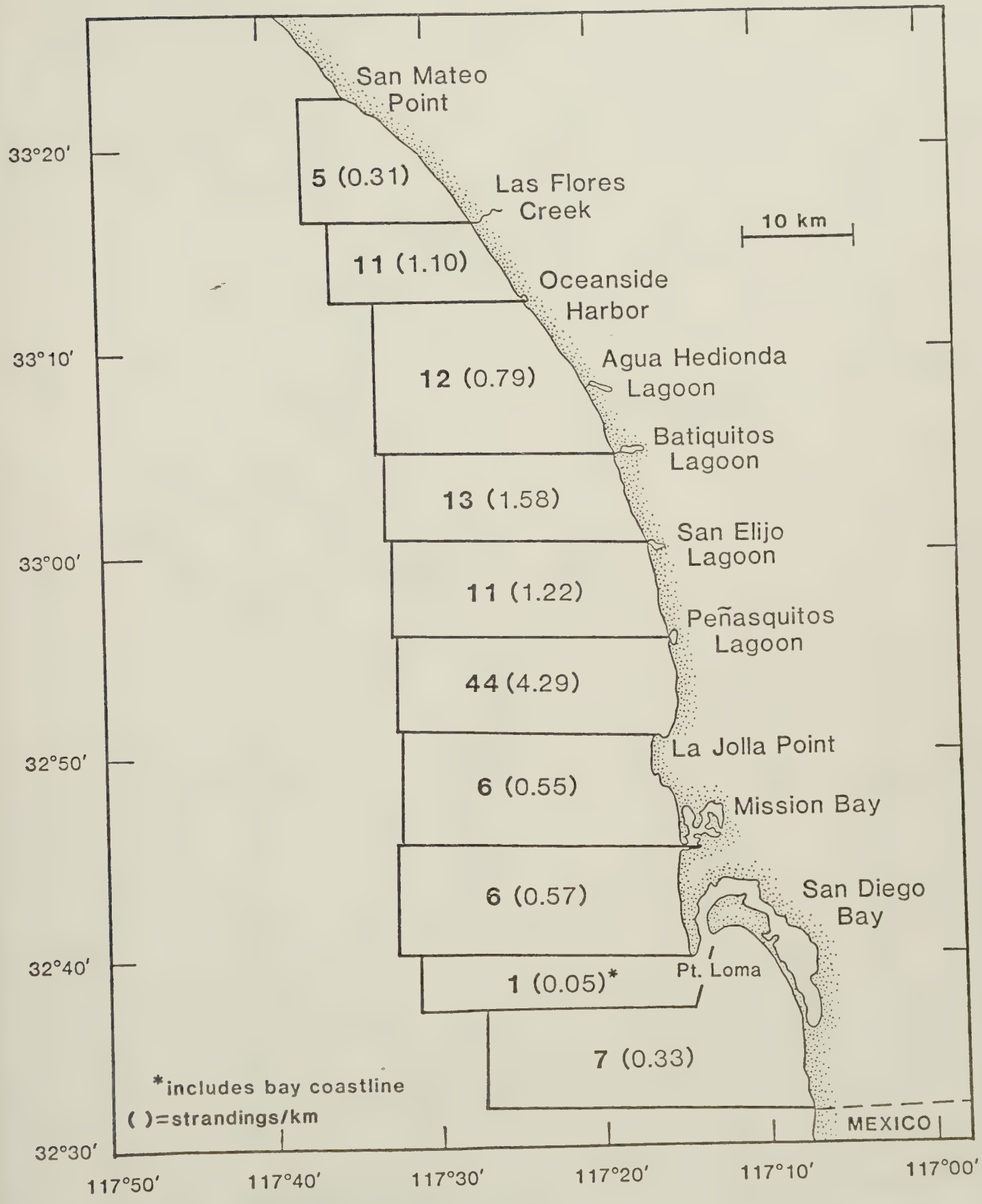

Figure 1: Numbers and approximate location of cetacean strandings in San Diego County, 1966-1980

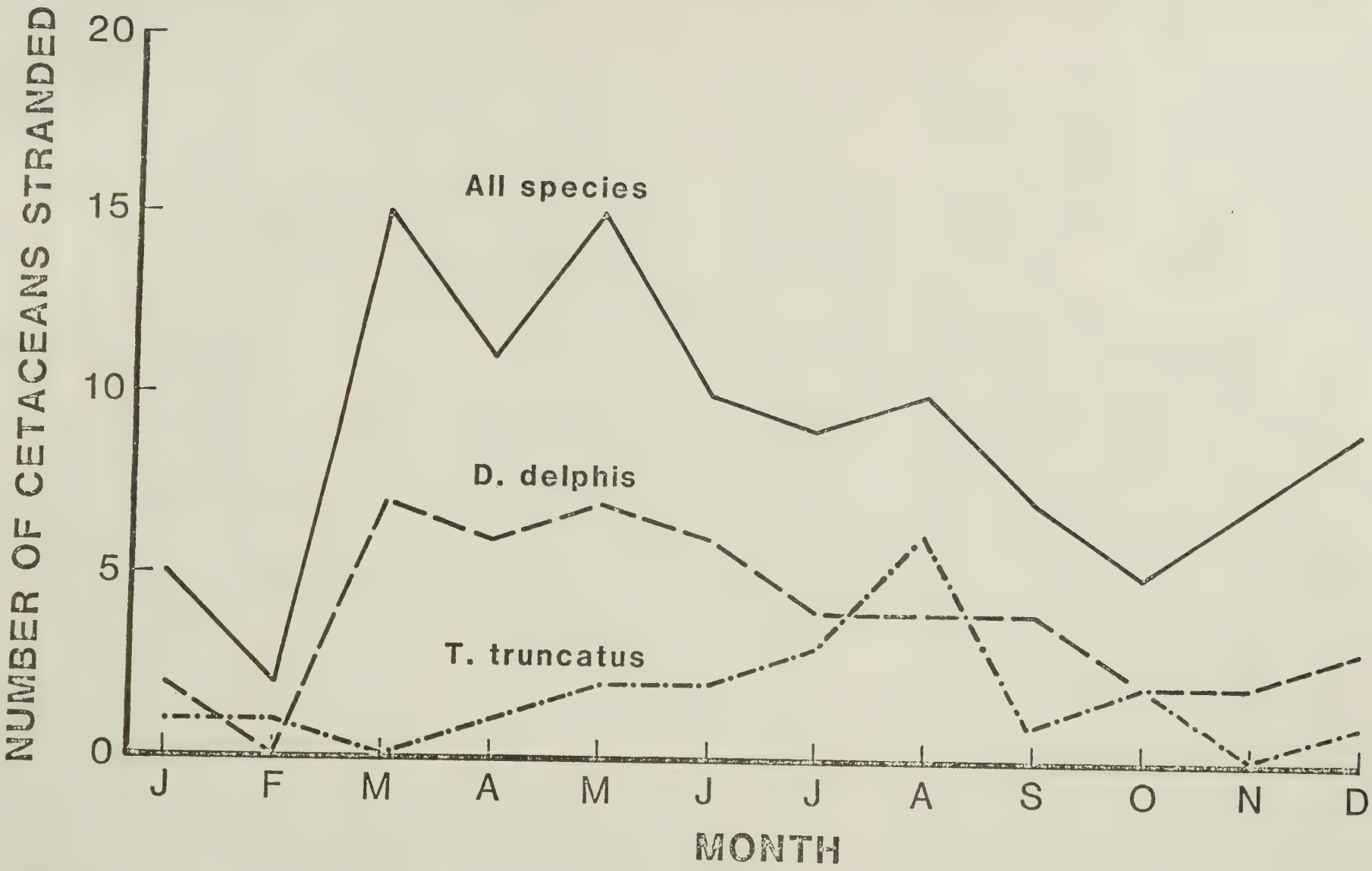

Figure 2 : Month of occurrence of cetacean strandings.

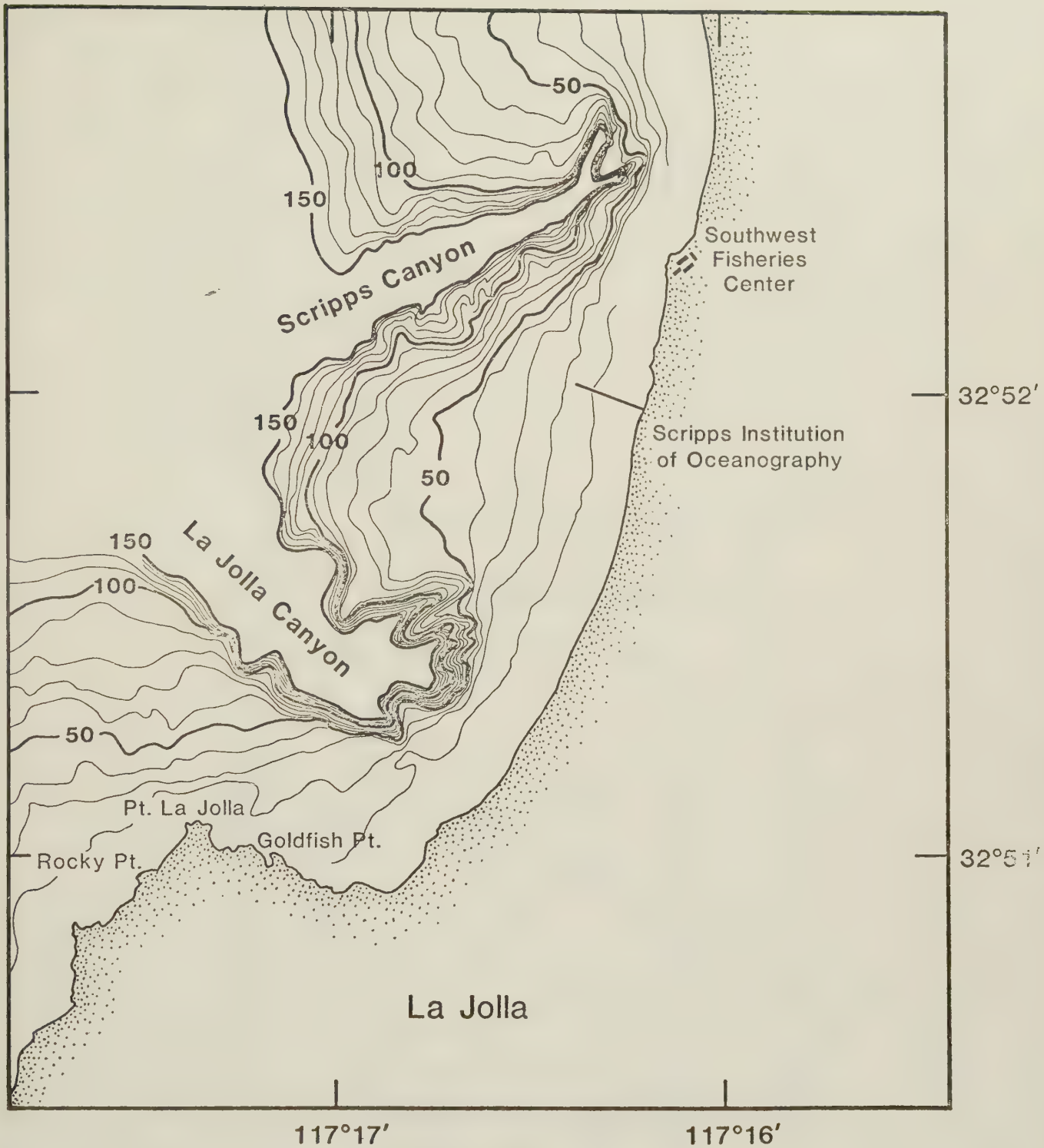

Figure 3 : Location of deepwater canyons in the La Jolla area (depth in meters) .

Figure 4a. Numbers of short-beaked Delphinus delphis stranded by month in San Diego County, 1966-1980.

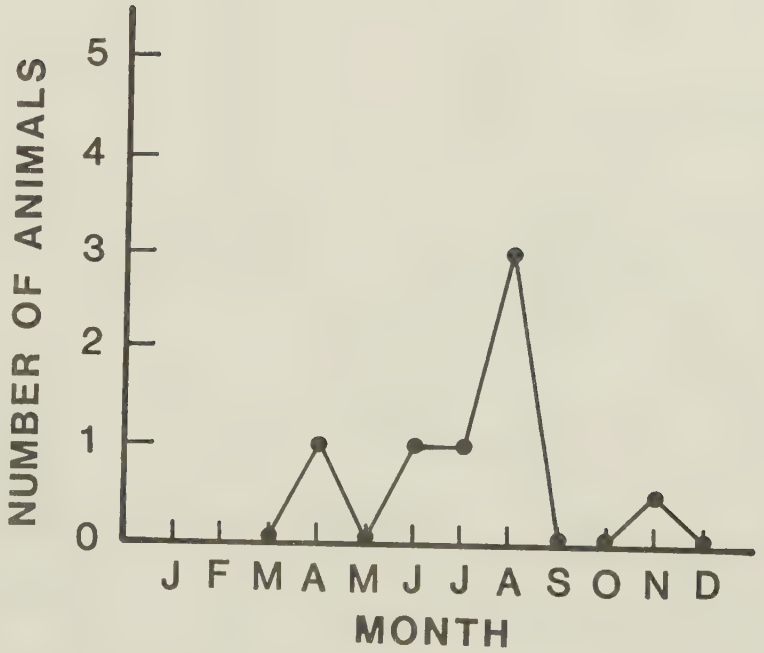

Figure 4b. Numbers of long-beaked Delphinus delphis stranded by month in San Diego County, 1966-1980.

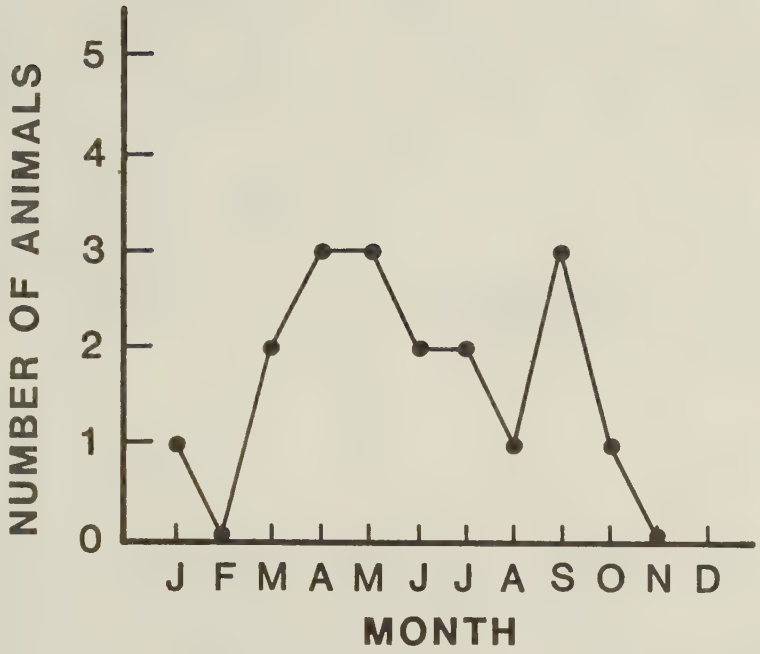

Figure 5a. Numbers of short-beaked Delphinus delphis males stranded by month in San Diego County, 1966-1980.

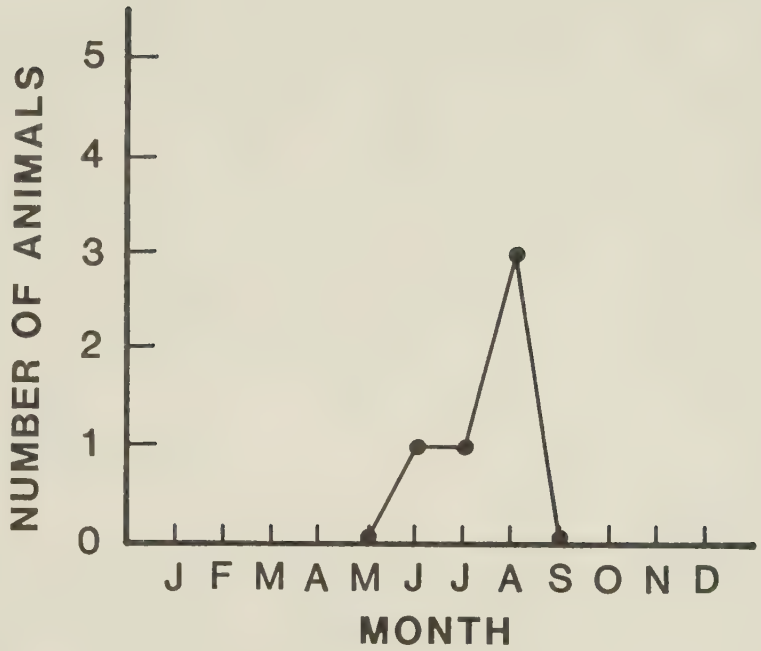

Figure 5b. Numbers of long-beaked Delphinus delphis males stranded by month in San Diego County, 1966-1980.

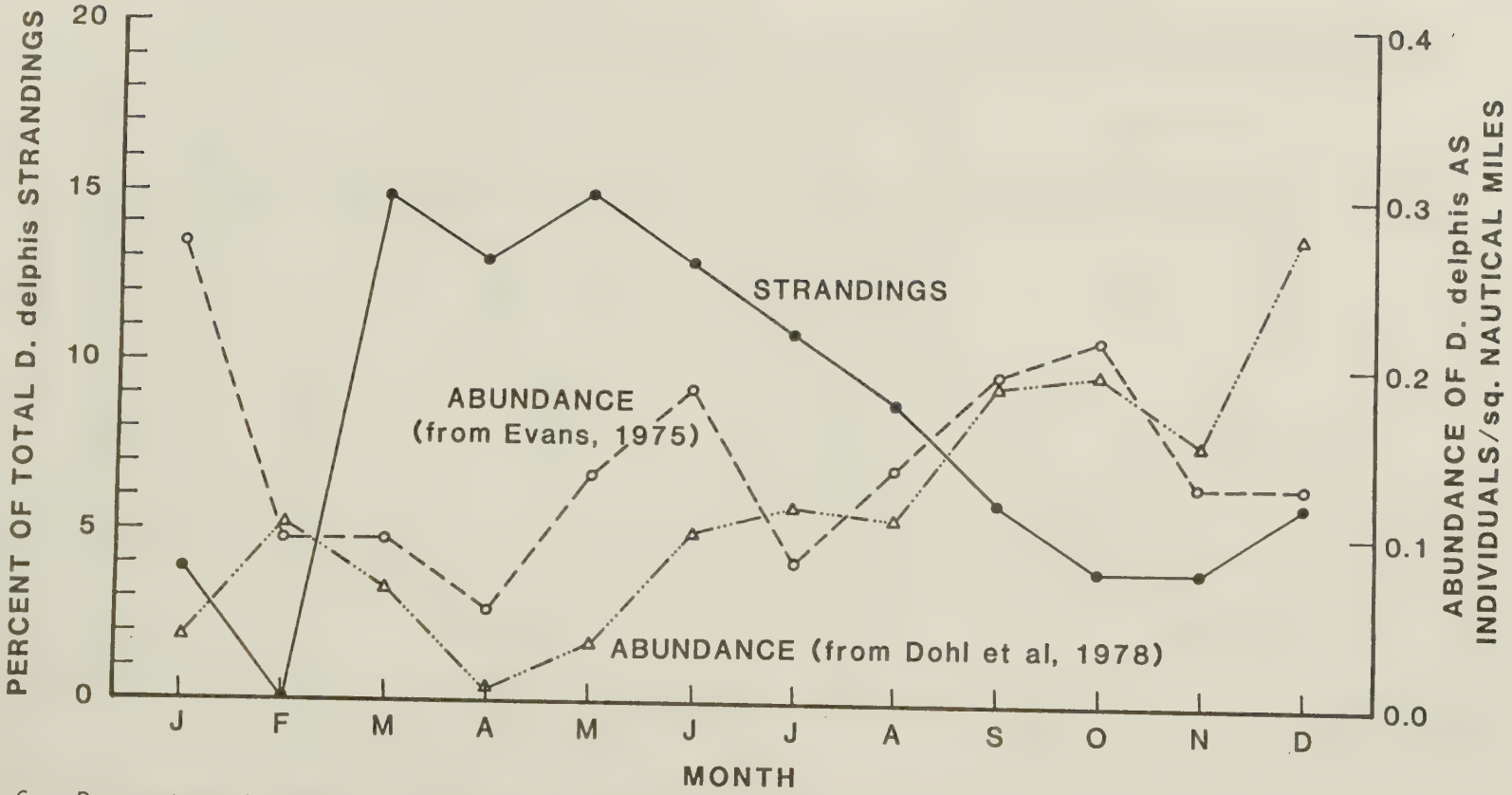

Figure 6. Percentage by month of the total Delphinus delphis strandings in San Diego County, 1966-1980, compared to relative abundance of D. delphis as reported by Evans (1975) and Dohl et al. (1978) for the Southern California Bight and nearby areas.

APPENDIX I

San Diego County Agencies Formally Notified of the Cooperative Marine Mammal Salvage Program

California State Lifeguard Service
P.O. Box 38
Carlsbad, CA 92008
Phone: (619) 729-8947

Coronado Lifeguard Service
Division of Recreation
714 Orange Avenue
Coronado, CA 92118
Phone: (619) 435-4179

Department of Animal Control
Central Animal Shelter
1104 Azusa Street
San Diego, CA 92110
Phone: (619) 297-2763

Imperial Beach Lifeguard Service
10 Palm Avenue
Imperial Beach, CA 92032
Phone: (619) 423-8322

Natural Resources Division
U.S. Marine Corps Base
Camp Pendleton, CA 92055
Phone: (619) 725-4512

San Clemente State Park Lifeguard Service
Pendleton Coast Area
3030 Avenida del Presidente
San Clemente, CA 92672
Phone: (619) 492-0802

San Diego City
Park and Recreation Department
Aquatic Division (Beach Clean-Up)
2581 Quivira Court
San Diego, CA 92109
Phone: (619) 483-0680 and 236-6652

San Diego County Lifeguard Service
P.O. Box 311
Solana Beach, CA 92075
Phone: (619) 755-1569

Carlsbad Police Department
1200 Elm Avenue
Carlsbad, CA 92008
Phone: (619) 729-7102

Del Mar Lifeguard Department
City of Del Mar
1050 Camino Del Mar
Del Mar, CA 92014
Phone: (619) 755-1556

Harbor Police
c/o San Diego Port District
P.O. Box 488
San Diego, CA 92113
Phone: (619) 291-3900

Mission Bay Harbor Patrol
2581 Quivira Court
San Diego, CA 92109
Phone: (619) 224-1862

Oceanside Lifeguard Service
130 Brook Street Pool
Oceanside, CA 92054
Phone: (619) 722-8000

San Diego City Lifeguard Service
2581 Quivira Court
San Diego, CA 92109
Phone: (619) 224-2709

San Diego Natural History Museum
P.O. Box 1390
San Diego, CA 92112
Phone: (619) 232-3821

Scripps Institution of Oceanography
Scripps Aquarium Museum
A-007
La Jolla, CA 92038
Phone: (619) 452-4086

APPENDIX I Continued

Scripps Institution
of Oceanography
Public Affairs Office
A-033
La Jolla, CA 92038
Phone: (619) 452-3624

U.S. Naval Amphibious Base, Coronado
Security Department
San Diego, CA 92155
Phone: (619) 437-2483

U.S. Coast Guard
Operations Center
2710 North Harbor Drive
San Diego, CA 92101
Phone: (619) 293-5870

Silver Strand/Borderfield
State Lifeguard Service
Silver Strand State Beach
Coronado, CA 92118
Phone: (619) 435-0126

U.S. Naval Degaussing Station
San Diego, CA 92152
Phone: (619) 225-6631

APPENDIX II - Strandings of cetaceans which SWFC investigated, 1966-1980.

Date	Sex	Length (cm)	Locality	Field No.	Specimen disposition**
Common dolphin, Delphinus delphis:					
9- 8-66	M	187	La Jolla Shores	WFP236	SWFC
4- 7-69	M	186	Carlsbad	WFP616	LACM
11-29-69	F	217	La Jolla Shores	WFP612	LACM
4- 6-70	M	192	Torrey Pines	WFP033	USNM
5- 8-70	F	180	Torrey Pines	WFP038	LACM
5- 9-70	M	163	Del Mar	WFP039	LACM
5-19-70	M	179	Torrey Pines	WFP040	LACM
5-28-70*	Unknown	Unknown	Black's Beach	None	None collected
8-17-70	M	224	Torrey Pines	WFP044	"Destroyed"
8-17-70	M	232	La Jolla Shores	WFP045	"Destroyed"
8-28-70	M	233	Torrey Pines	WFP046	LACM
10-22-70	M	185	La Jolla Shores	WFP060	LACM
11- 9-70	M	180	Leucadia	WFP061	LACM
4-11-72	M	185	La Jolla Shores	WFP217	USNM
6- 3-72	Unknown	Unknown	Black's Beach	WFP218	USNM
6-27-72	Unknown	Unknown	Torrey Pines	WFP220	NOSC
6-27-72	M	Unknown	Black's Beach	WFP221	NOSC
7- 5-72*	Unknown	169	Camp Pendleton	WFP223	LACM
7- 5-72*	M	Unknown	Camp Pendleton	WFP224	LACM
7- 5-72	M	Unknown	Camp Pendleton	WFP225	SWFC
7- 5-72*	M	Unknown	Camp Pendleton	WFP227	SWFC
7- 5-72*	Unknown	Unknown	Camp Pendleton	None	None collected
1- 2-73	F	Unknown	Ocean Beach	WFP233	NOSC
1-15-73*	Unknown	Unknown	Cardiff	WFP234	LACM
3- 9-73*	Unknown	Unknown	Camp Pendleton	WFP246	LACM
3-29-73	M	Unknown	Cardiff	WFP264	LACM
4-25-73	F	213	Black's Beach	WFP266	NOSC
3- 4-74	F	183	La Jolla Shores	WFP309	LACM
4-16-74	M	193	Black's Beach	WFP465	SWFC
7-22-74	F	178	Leucadia	WFP473	LACM
12- 2-74*	M	196	Torrey Pines	WFP479	USNM
12- 9-74	M	196	Black's Beach	WFP480	USNM
12-27-74	F	Unknown	La Jolla Shores	WFP481	NOSC
3-11-75	M	187	Leucadia	WFP485	USNM
3-15-75	M	Unknown	Cardiff	WFP487	DC
3-31-75	M	184	Pacific Beach	WFP488	USNM
4- 1-75	F	151	Carlsbad	WFP490	USNM
5-21-75	F	Unknown	La Jolla	WFP495	NOSC
6-11-75	M	205	Leucadia	WFP498	NOSC
7- 6-75	F	182	Carlsbad	WFP505	NOSC

APPENDIX II - Continued

Date	Sex	Length (cm)	Location	Field No.	Specimen disposition**
Common dolphin, Delphinus delphis (continued):					
9-17-75	M	Unknown	Black's Beach	WFP508	HSRI
12-15-75	M	Unknown	Torrey Pines	WFP510	LACM
1-15-76	M	189	Torrey Pines	WFP512	LACM
4-19-76*	M	196	Coronado	WFP517	LACM
6-21-76	M	195	Carlsbad	WFP519	LACM
10- 3-76	M	197	Cardiff	WFP552	LACM
3-27-77	M	200	Carlsbad	WFP560	SWFC
5- 4-77	M	Unknown	Del Mar	WFP561	SWFC
5- 7-77	M	189	Leucadia	WFP562	None collected
9 -9-78	M	180	Carlsbad	WFP583	MOLR
5-11-79	F	176	Leucadia	WFP595	SWFC
7-26-79	M	231	Del Mar	JRH049	SWFC
6-16-80	F	183	Encinitas	JRH065	SWFC
7-29-80	M	190	Carlsbad	JRH071	SWFC
8-13-80	M	175	San Diego Bay	JRH074	SWFC
Bottlenose dolphin, Tursiops truncatus:					
4-27-70	M	310	Torrey Pines	WFP036	USNM
7- 5-72*	M	Unknown	Camp Pendleton	WFP222	LACM
8-22-73	M	113	San Ysidro	WFP278	USNM
8- 2-74	F	263	Carlsbad	WFP474	LACM
10-31-74*	F	Unknown	La Jolla Shores	WFP475	LACM
10-22-75	F	202	San Diego County	WFP509	USNM
1- 8-76	M	319	Carlsbad	WFP511	None collected
6-28-76	M	281	Cardiff	WFP520	WAW
7-27-76	F	211	Torrey Pines	WFP522	WAW
8- 2-76	F	255	San Ysidro	WFP523	WAW
8- 9-76	M	313	Black's Beach	WFP535	USNM
8-31-76	F	Unknown	Leucadia	WFP537	WAW
2- 5-77	M	303	Black's Beach	WFP559	SWFC
5-16-77	F	234	Black's Beach	WFP563	SWFC
6-27-77	M	267	Del Mar	WFP565	SWFC
5- 1-79*	F	145	Torrey Pines	WFP593	SWFC
8-21-79	F	127	Carlsbad	JRH050	SWFC
5-13-80	F	251	La Jolla Shores	JRH057	SWFC
6- 1-80	M	329	Torrey Pines	JRH058	SWFC
7- 7-80	M	131	Coronado	JRH067	SWFC
7-24-80	F	127	La Jolla	JRH070	SWFC
8- 3-80*	F	309	San Onofre	JRH073	SWFC
9-10-80	M	121	Black's Beach	JRH077	SWFC
10-22-80	F	168	Del Mar	JRH084	SWFC
12-31-80	M	311	Camp Pendleton	JRH095	SWFC

APPENDIX II - Continued

Date	Sex	Length (cm)	Locality	Field No.	Specimen disposition**
Pacific white-sided dolphin, Lagenorhynchus obliquidens:					
5- 7-70	F	202	La Jolla	WFP037	LACM
6-18-70	F	Unknown	Black's Beach	WFP043	LACM
5-16-71	M	187	La Jolla Shores	WFP082	LACM
12- 3-71	F	178	Del Mar	WFP185	UCLA
11-14-71	F	Unknown	Cardiff	WFP231	LACM
7-15-74	F	223	La Jolla Shores	WFP472	LACM
5-20-76	M	Unknown	Camp Pendleton	WFP518	NOSC
4-17-79	F	208	La Jolla Shores	WFP591	USNM
3- 6-80	F	187	Carlsbad	JRH054	SWFC
9-16-80*	Unknown	188	Camp Pendleton	JRH078	SWFC
12-21-80	F	222	Pacific Beach	JRH094	SWFC
Gray whale, Eschrichtius robustus:					
4-23-75*	F	1290	Camp Pendleton	WFP492	None collected
10-14-76	M	800±30	Mission Beach (floating offshore)	WFP553	None collected
1-25-78	F	391	Camp Pendleton	WFP570	None collected
3- 2-78	M	499	Torrey Pines	WFP573	None collected
5- 5-78	F	578	Leucadia	WFP577	None collected
2- 1-79	Unknown	585+	Coronado	WFP585	None collected
5-22-79	M	775	Ocean Beach	JRH046	None collected
12-10-79	F	600	Point Loma	None	None collected
1-11-80	F	439	Encinitas	JRH053	None collected
3-30-80	M	1240	Mission Beach	JRH055	SDMNH
Dall's porpoise, Phocoenoides dalli:					
?- ?-71	Unknown	Unknown	Camp Pendleton	WFP226	LACM
11- 7-72	F	Unknown	Camp Pendleton (exact site unknown)	WFP230	LACM
3-14-23	F	Unknown	Black's Beach	WFP248	LACM
4-25-75	F	185	Leucadia	WFP493	USNM
3- 3-79	F	207	Ocean Beach	WFP586	NWAFC
Shortfin pilot whale, Globicephala macrorhynchus:					
3-12-73	F	453	Solana Beach	WFP247	LACM
3-15-73	F	437	Black's Beach	WFP249	LACM
4- 3-73	F	434	Camp Pendleton	WFP265	LACM?
11- 3-80	M	316	San Onofre	JRH086	SDMNH

APPENDIX II - Continued

Date	Sex	Length (cm)	Locality	Field No.	Specimen disposition**
Hector's beaked whale, *Mesoplodon hectori*:					
5-22-75	M	210	Camp Pendleton (SO.)	WFP496	USNM
5-28-75*	F	444	Camp Pendleton (exact site unknown)	WFP497	USNM
9- 9-78	M	390	Carlsbad	JGM391	USNM
12-27-79	M	245	Torrey Pines	JRH052	SWFC
Cuvier's beaked whale, *Ziphius cavirostris*:					
6-14-77	F	557	Black's Beach	WFP564	SW
11-20-80	M	526	Black's Beach	JRH087	USNM
Northern right whale dolphin, *Lissodelphis borealis*:					
6- 8-73	M	268	Pacific Beach (offshore in water)	WFP272	USNM
9-11-73	F	226	La Jolla Shores	WFP279	SDNHM
Hubb's beaked whale, *Mesoplodon carlhubbsi*:					
11-13-74	F	532	Ocean Beach	WFP482	USNM
Risso's dolphin, *Grampus griseus*:					
3-14-78	F	234	Point Loma	WFP575	SW
Sperm whale, *Physeter macrocephalus*:					
12-20-72*	M	Unknown	Camp Pendleton (exact site unknown)	WFP232	LACM

APPENDIX II - Continued

Date	Sex	Length (cm)	Locality	Field No.	Specimen disposition**
Striped dolphin, *Stenella coeruleoalba*:					
6-26-79	M	198	Imperial Beach	JRH047	SWFC

* Carcass extremely decomposed; date of recovery.
** LACM: Los Angeles County Museum of Natural History, Los Angeles, CA
NOSC: Naval Ocean Systems Center, San Diego, CA
NWAFC: Northwest and Alaska Fisheries Center; National Marine Mammal Lab, Seattle, WA
SDMNH: San Diego Museum of Natural History, San Diego, CA
SW: Sea World, Inc., San Diego, CA
SWFC: Southwest Fisheries Center, La Jolla, CA
UCLA: University of California, Los Angeles, CA
USNM: United States National Museum, Smithsonian Institution, Washington D.C.
DC: D. Clerenger, Flagstaff, Arizona
WAW: W. A. Walker, Palos Verdes, CA
HSRI: Hubbs-Sea World Research Institute, San Diego, CA
MOLR: Musee Oceanographique, La Rochelle, France

APPENDIX III - Strandings of pinnipeds which SWFC investigated, 1966-1980

Date	Sex	Length (cm)	Locality	Field No.	Specimen disposition**
California sea lion, *Zalophus californianus*:					
6- 3-72*	Unknown	Unknown (juvenile)	Black's Beach	WFP219	USNM
9-25-73	M	Unknown (sub-adult)	La Jolla Shores	WFP286	USNM
12- 2-74	F	Unknown (adult?)	La Jolla Shores	WFP478	USNM
2- 6-75*	F	174	Carlsbad	WF483	SWFC
3- 2-76*	F	168	Pacific Beach	WFP513	None collected
3- ?-78*	Unknown	Unknown	Leucadia	WFP574	None collected
4-24-78	M	150+ (no head)	Leucadia	WFP576	None collected
3-23-79	F	98	La Jolla Shores	WFP587	NWAFC
7-18-79	F	102	Carlsbad	JRH048	SWFC
4-30-80	F	203	San Clemente	JRH056	None collected
6- 1-80*	F?	111	Torrey Pines	JRH059	None collected
6- 6-80	M	181	San Onofre	JRH060	SWFC
6- 6-80*	M	173	San Onofre	JRH061	None collected
6- 6-80	M	185	La Jolla Shores	JRH062	SWFC
6-20-80	F	181	Leucadia	JRH066	None collected
7-31-80	M	205	Mission Beach	JRH072	SWFC
8-17-80	Unknown	Unknown	Imperial Beach	JRH075	None collected
10- 2-80	M	210	Mission Beach	JRH080	SWFC
10- 6-80	F	181	Pacific Beach	JRH082	SWFC
10-16-80	M	126	Oceanside	JRH083	SWFC
10-29-80	F	164	Cardiff	JRH085	SWFC
12- 5-80	M	123	Ocean Beach	JRH088	SHC
Northern elephant seal, *Mirounga angustirostris*:					
3-13-75*	M?	Unknown (sub-adult)	Del Mar	WFP486	SDMNH
5-13-79	F	198	Encinitas	WFP596	SWFC
9-18-80	M	270	San Diego Bay	JRH079	SWFC
Harbor seal, *Phoca vitulina*:					
1-10-74*	Unknown	Unknown	Black's Beach	WFP306	
6-19-75	Unknown	93	Carlsbad	WFP499	USNM

APPENDIX III - Continued

Date	Sex	Length (cm)	Locality	Field No.	Specimen disposition**
Northern sea lion, Eumetopias jubatus:					
1-10-74	F	Unknown	Black's Beach	WFP305	USNM
Unidentified otariid					
?- ?-79	M	Unknown	Pacific Beach	JRH051	None collected

* Carcass extremely decomposed; date of recovery.

** NWAFC: Northwest and Alaska Fisheries Center, Seattle, WA
SDMNH: San Diego Museum of Natural History, San Diego, CA
SWFC: Southwest Fisheries Center, La Jolla, CA
USNM: United States National Museum, Smithsonian Institution, Washington D.C.
SHC: South Hampton College, Long Island, New York